Consideration of Comments for Two Eagle

Comment Period
The Comment period for the Two Eagle Vegetation Management Project started on 6/6/2019. The Responsible Official requested comments back within 30 calendar days. While comments may be submitted at any time, for the purposes of this comment period, comments were accepted through 7/5/2019.

Parties Responding to Comment

Table 1: Parties that Responded

Name	Acronym	Project File Document Name
Oregon Wild	OW	20190701_TE_OregonWildCommentLetter
AFRC	AFRC	20190703_TE_AFRCCommentLetter

Comment Analysis & Response

Comments were reviewed by the interdisciplinary team (ID team) to determine if issues or concerns were raised that demonstrated a clear cause-effect relationship and if recommendations/remedies were suggested that would address the issue/concern. Issues raised by multiple parties are listed once. If comments were supportive in nature and provided no issues/concerns or recommendations, they are not analyzed further in this document but are included in the project record.

Table 2: Comment Analysis & Response

ISSUE/CONCERN (PARTY/IES ACRONYM)	RECOMMENDATION/ SUGGESTED REMEDY	RESPONSE	REMARKS AND/OR PROJECT RECORD CITATIONS
Fuels			
#1: Moist mixed forest restoration (OW)	Not a priority for treatment to reduce crown fire potential	Comment considered but no changes needed	See comment #1
#2: Responsible fuels reduction (OW)	Focus treatment in structure ignition zone	Comment considered but no changes needed	See comment #2
#3: Canopy reduction and complex effects	Prioritize canopy treatments in WUI	Comment considered but no changes	See comment #3

ISSUE/CONCERN (PARTY/IES ACRONYM)	RECOMMENDATION/ SUGGESTED REMEDY	RESPONSE	REMARKS AND/OR PROJECT RECORD CITATIONS
including drying of surface fuels, increased shrub component and removing larger heat tolerant trees (OW)		needed	
#4: Climate as a better predictor of large fire behavior than fuels (OW)	Support efforts to limit initiation and spread of crown fires in appropriate forest types through reduction of fine surface fuels and ladder fuels, but oppose efforts to heavily thin overstory	Comment considered but no changes needed	See comment #4
#5: Fuel Breaks (OW)	Should focus on surface and ladder fuels while retaining relatively dense canopy	Comment considered but no changes needed	See comment #5; Please refer to pages 1-2, 8-9 of the Fire/Fuels Effects in the Project File and page 70-77 of the EA.
#6: Treatment in stands that have not missed fire cycle (OW)	Don't modify fire cycle, and only treat naturally dense stands in structure-ignition zone	Comment considered but no changes needed	See comment #6
Wild and Scenic Eagle Creek			
#7: Commercial treatments and compliance with Eagle Creek WSR Plan (OW)	Consider alt with no commercial treatment in WSR	Analysis supplemented, improved or modified	See WSR specialist report in the Supporting documents file on the Two Eagle project webpage. See VQOs in Mitigations and PDCs.
Undeveloped areas			
#8: EA did not consider OW proposed alternative (OW)	Only non-mechanical treatments in undeveloped areas	Comment considered but no changes needed	See comment #8. No treatments are proposed in the Boulder Park IRA. Maps are provided on the web. Treatments within unroaded areas are within designated WUI.

ISSUE/CONCERN (PARTY/IES ACRONYM)	RECOMMENDATION/ SUGGESTED REMEDY	RESPONSE	REMARKS AND/OR PROJECT RECORD CITATIONS
Transportation			
#9: New roads should be avoided (OW)	Treat accessible areas from existing roads, consider non-commercial and Rx fire only in areas requiring temp roads	Comment considered but no changes needed	See comment #9. See p. 20-22 of EA for the Post Sale Road Management.
#10: Forest roads are essential for active management (AFRC)	Utilize existing road beds and closed roads for temp road construction where possible, do not decommission roads, use gates or other physical barriers to provide future access	Comment considered but no changes needed	Gates proposed, see Post Sale Road Management Plan p. 20-22 of EA.
Biomass			
#11: Repeated entries would cause cumulative impacts on resources (OW)	Avoid repeated entries	Comment considered but no changes needed	Biomass removal pertains to one mechanical entry for all units that have a prescription fuels reductions with commercial removal (WFM).
Soil			
#12: Soil impacts underestimated (OW)	Disclose methodology for DSCs and impacts other than DSCs	Comment considered but no changes needed	See soil specialist report, located in the supporting documents of the project webpage
#13: Logging harms soil and reduces site productivity (OW)		Comment considered but no changes needed	This project has been planned and will be conducted so that land management activities maintain or improve soil quality. Refer to mitigations on p. 32-35 of the EA.
#14: Specific detail on logging systems limits the ability of operators (AFRC)	Remove specific details about logging systems and analyze all units for skyline and tractor based systems	Comment considered but no changes needed	The soil analysis evaluated logging systems based on hillslope suitability. See Timber Management Standards and Guidelines of the WWNF LRMP (4-50).
Climate Change			

ISSUE/CONCERN (PARTY/IES ACRONYM)	RECOMMENDATION/ SUGGESTED REMEDY	RESPONSE	REMARKS AND/OR PROJECT RECORD CITATIONS
#15: Climate analysis misleading and incomplete (OW)	Consider direct/indirect effects of GHG emissions from logging on climate – with and without logging	Comment considered but no changes needed	See comment #15
#16: Management and carbon sequestration (OW)	Consider in analysis types of treatments and how they affect carbon sequestration potential through time	Comment considered but no changes needed	See comment #16
#17: Logging to reduce fire effects does not result in a net increase in forest carbon storage (OW)	Unsure of what is recommended	Comment considered but no changes needed	See comment #17
#18: Carbon storage in wood products does not offset emissions from harvest (OW)	Unsure of what is recommended	Comment considered but no changes needed	See comment #18
Silviculture			
#18: Retain genetic diversity (OW)	Protect large and/or legacy trees, and let natural processes determine which of the younger trees are most fit to survive	Comment considered but no changes needed	See comment #19
#19: Basal area retention (OW)	Quantitatively disclose in EA with alternative levels of retention, with 60-120ft^2 retention preferred	Comment considered but no changes needed	See comment #20
Wildlife			
#21: Basal area retention and green	Do not manage for tree vigor and minimum	Comment considered but no changes	See p. 38 of the EA for Green Tree Replacement standards

ISSUE/CONCERN (PARTY/IES ACRONYM)	RECOMMENDATION/ SUGGESTED REMEDY	RESPONSE	REMARKS AND/OR PROJECT RECORD CITATIONS
tree recruitment for snags (OW)	stocking because it will not provide enough green trees for recruitment of snags	needed	
NEPA/NFMA			
#22: Supports project specific FPA to cut large trees (AFRC)	Cut white fir up to 30”, select alternative D – modified proposed action	Comment considered but no changes needed	Alternative was considered, not analyzed in detail. See Alternative C on p. 14 of the EA
#23: Design elements and mitigation Measures too specific (AFRC)	Place this in an appendix	Comment considered but no changes needed	See comment #23
RHCA Treatment			
#24: Thinning in RHCAs accelerates production of large trees (AFRC)	Consider proactive management in RHCA	Comment considered but no changes needed	See comment #24
Invasives			
#25: Fuels breaks contribute to spread of invasives (OW)	Unsure what is being suggested	Comment considered but no changes needed	While ground disturbance and shade removal potentially promote invasive plant establishment and spread, the benefits of curtailing potential large scale fires offsets these risks.

OW#1: Moist mixed forests not a high priority for restoration

Response: Refer to pages 1-3 of the Fire/Fuels Effects and Pages 67-78 of the EA.

“Restoration of moist mixed forest” and reducing fire severity in forests historically characterized by infrequent, stand-replacement fire regimes” are not the primary objectives of the proposed treatments within this analysis.

The principles that guide the fuels reduction treatments come from the Cohesive Wildfire Strategy. The intent of the mixed and high severity fire regime treatments is to create and maintain strategically located fuel reduction areas (DFPZ’s). Departure from “historic fire return interval” was *not identified as a reason for treatment in high severity fire regimes. The fuels reduction treatments in mixed and high severity fire regimes are based on the need to reduce existing fuel loadings and the associated fire behavior to desired conditions.*

Fire severity and fire intensity are two distinct features of fire; the terms are often incorrectly interchanged. Fire intensity describes the energy released from the fire or characteristics of the fire behavior such as flame length and rate of spread. Fire severity refers to the ecosystem impacts of a fire such as damage to vegetation and impacts on the soil. In forests, fire severity is measured in terms of tree mortality, canopy loss, or bole and crown scorch. The treatments proposed in moist and cold forest in this analysis are designed to reduce fire intensity in strategic locations, not to reduce fire severity.

The Two Eagle project area is located adjacent two large unmanaged portions of public lands (Eagle Cap Wilderness and Boulder Park IRA) on the north and privately owned land to the south. Existing Fire behavior within the unmanaged public land has the potential to be very erratic, very fast spreading and very persistent to being suppressed as demonstrated by past wildfires (Trout Creek, Mule peak and Eagle Complex fires) adjacent to this analysis area. Proposed treatments within this project are designed to reduce fire intensity by reducing surface and crown fuels in strategic locations thus decreasing the likelihood a wildfire originating on public land would spread on to private land. The proposed treatments would also create a modified fuel bed adjacent to the Wilderness and Roadless areas that would allow for increased opportunities to use wildfire for ecological benefit when conditions are appropriate.

The purpose of this project is:

- *To actively manage surface, ladder, and crown fuels in the Wildland Urban Interface Zones (WUIZ) creating strategic and safe areas for fire suppression activities. These strategically placed fuels reduction treatments would modify potential fire behavior thus slowing the progression of wildfires and increasing suppression opportunities.*
- *To restore and promote forest structural and compositional conditions reflective of historical ranges of variation (HRV) in dry upland forest.*
- *To enhance landscape resilience to future wildfire, insect and disease risk.*
- *To capitalize on the opportunity to apply cohesive wildfire strategy principles across all land ownerships.*
- *To modify fuels in strategic location adjacent to the Wilderness and Roadless areas to decrease risks associated with using future natural fire ignitions for ecosystem benefit.*

OW#2: Responsible Fuel reduction - "Fuel reduction has significant trade-offs, because "fuels" provide habitat, scenery, carbon storage, hydrologic stability, and many other values".

Response: Two Eagle treatments were created in an Interdisciplinary Team (IDT) process to ensure that wildlife habitat, threatened and endangered species, scenery, carbon storage, hydrologic stability, cultural resources and other values were incorporated into project design. Please refer to the specialist reports in the project file for information on other values identified within the project area.

OW #3: Canopy fuels – The EA fails to recognize that treating canopy fuels has complex effects. Retaining canopy fuels actually helps maintain a cool, moist, less windy microclimate, helps reduce generation of slash, and helps suppress the growth of surface and ladder fuels. These effects all help moderate fire severity.

The canopy fuels treatments proposed in this project are "thin from below" treatments leaving the largest trees on site, while focusing removal on ladder fuels. The reduction of canopy bulk density and the increase in canopy base heights would decrease the potential for crown fire in treated stands (Reference fire behavior modeling on pages 73-75 of the EA).

Effects of harvest slash - The proposed thinning treatments will create a short term increase in fine fuel loadings (3 inch minus size classes) immediately following activities. These fine fuel loadings are expected to range from 5 - 10 tons per acre. All thinning treatments would be followed by prescribed fire or other mechanical treatments to reduce surface fuels thereby reducing the intensity of potential wildfires (Graham, McCaffery and Jain. 2004).

Fire hazards immediately following activities are not severely elevated due to the green nature of the slash. Depending on the weather, the slash could cure rapidly and present a short-term (several months) elevated hazard risk in the late summer before fall rains/snows arrive. A curing period is required to achieve desired fuel consumption when prescribed burning. Fuel loadings generally are compacted closer to the ground by winter snowpack (reducing the potential for crown fire), and after a period of drying in the late spring/early summer they are generally ready for prescribed burning. Therefore, if the fuels reduction treatment takes place within the year following harvest, there is a short term (3 month) period of elevated potential for high intensity burning conditions in the event of a wildfire during this period. This occurrence depends largely on weather conditions and the relatively low potential for an ignition in that exact same area. This risk would be immediately reduced following the completion of the activity. Should the slash reduction be delayed this risk would remain in place for the hottest four months each summer for a 2 year period after which the fine fuels will be on the ground and decomposed to the point that they are no longer a flash fire hazard. Please refer to pages 9-11 of the Fire/Fuels Effects in the Project File.

Effects on large diameter trees (greater than 21" DBH) – Thin from below treatments would protect and enhance the growth of large fire resistant trees. These treatments would be designed to leave the largest/healthiest trees on site to provide shading of surface fuels and moderation of wind.

Effects of thinning on surface fuels moisture – Research has shown that surface fuel moisture differences between thinned and unthinned stands were not significant and occurring only for large diameter woody fuels in the early season, when fuel moisture values are typically high and fire danger is low (Estes, Knapp, Skinner and Uzoh, International Journal of Wildland Fire, 2012, 21, pg 428-435). Faiella and Bailey (2007) found no significant difference in fuel moisture of 1 hour and 10 hour fuels between unthinned and thinned stands. Any effect from thinning on fuel moisture levels is likely to be greater following precipitation events when fuel moisture levels are high, possibly due to how thinning influences interception of the rain or snow by the canopy. The decreased canopy closure as a result of thinning means that less precipitation is intercepted by the canopy in thinned stands, allowing for more rain and snow to reach the forest floor. The long hot and dry summers which occur in eastern Oregon have a much larger effect on fuel moisture than the canopy cover. Fuel moisture differences resulting from the proposed treatments would not be expected to substantially influence fire behavior during times of the highest fire danger.

Effects of thinning on wind speed and surface fuel temperatures – It is not anticipated that the "thin from below" treatments will place surface fuels in an unsheltered wind status. Fire behavior modeling was conducted utilizing partially sheltered wind speed adjustment factors of .3 for both pretreatment and post treatment stand comparisons.

Stands which have an HPO prescription may create unsheltered fuels conditions at a very small scale which may slightly increase surface wind speeds and the added sunlight may cause local increases to surface fuel temperatures, both of which could have slight influences on fire rates of spread. However, any enhancing effect on stand wind speeds and surface fuels temperatures due to thinning would be compensated by the reduction in ladder and crown fuels, as long as surface fuels are adequately treated (Weatherspoon 1996; Agee and Skinner 2005).

OW #4: Climate is a better predictor of large fire behavior than fuels.

Climate/weather is an element of large fire behavior. The fire environment has three elements; available fuels (vegetation), existing topography, and weather/climate. The three elements must be combined in the right proportions for a large wildfire to occur. Of these, only the fuels element can be altered by management actions.

OW #5: Fuels Breaks – Fuels breaks should focus on surface fuels and ladder fuels, retain relatively dense canopy. In designing fuels breaks, the FS should focus dense young stands with fuels close to the ground. Mature forest are already fire resistant. Logging them might do more to increase (instead of reduce) fire hazard.

Response: Please refer to pages 1-2, 8-9 of the Fire/Fuels Effects in the Project File and page 70-77 of the EA.

The fuels breaks or Defensible Fuels Profile Zones (DFPZ) proposed in this project focus on reducing surface fuels, increasing the height to the base of the live crown, and reducing canopy bulk density where needed through "thinning from below". The largest trees in the stands are left to create cover/shade and moderate wind speeds. Implementation of these strategically placed treatments would modify those stand characteristics and change the behavior of a wildfire entering a DFPZ.

Ladder fuel is defined as any combustible vegetation which provides vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees with relative ease. They help initiate and assure the continuation of crowning

Research has shown that thinning (removing ladder fuels and decreasing tree crown density) followed by prescribed fire or other mechanical treatments that reduce surface fuel amounts will reduce the intensity of potential wildfires (Graham, McCaffery and Jain. 2004. RMRS-GTR-120). Many of the forested stands within the project area have not experienced fire or thinning for several decades. Heavy thinning combined with prescribed-fire or other surface fuels treatments, or both is necessary to effectively reduce potential fire behavior and crown fire hazard (PNW-GTR-628). The proposed commercial thinning treatments that reduce canopy bulk density would reduce the potential for crown fire development if surface fuels are concurrently treated (Cruz et al. 2002, Rothermel 1991, Scott and Reinhart 2001, van Wagner 1977).

A surface fire may make the transition to some form of crown fire depending on the surface fire intensity and crown characteristics (Van Wagner1977 and 1993). Fuel reduction treatments including prescribed fire, mechanical thinning, mastication and pile burning, are designed to reduce fire behavior potential by removing surface fuels, increasing the height of the canopy and reducing canopy fuels while retaining large fire–resistant trees (E.L Kalies, L.L Yocum Kent / Forest Ecology and Management 375, 2016).

OW#6: Forest are naturally dense and have not missed a fire cycle and do not need restoration. Focus on structural-ignition zone. Don't modify natural fuel/fire cycle.

We agree that fire is a natural part of the forces that shape a landscape (refer to pages 68-69 of the EA). The intent of this project is to create and maintain strategically located fuels treatments which compartmentalize the project area and reduce the potential size of wildfire, not eliminate it. Given the types of potential vegetation groups within this project area and their juxtaposition to private property, WUI, Inventory Roadless and Wilderness, fire managers are seeking to successfully utilize and manage fire on the landscape that are hundreds of acres in size not thousands of acres. This would create the heterogeneity desired but also maintain recreation opportunities, habitat for endangered species and decrease risks to private property.

Our desired future conditions is for fire to play a role in creating ecologically resilient forest conditions. It is desired that fire regimes return to within or near to their historical range of frequency and exhibit fire behavior, effects and other associated disturbances similar to those that occurred prior to fire exclusion. With the recognition that past management activities have resulted in unnatural densities of small trees, treatments aim to create conditions that will allow fire return to the landscape without putting the entire watershed at risk. We recognize the important role that stand replacement fires play within mature forest. However mature stands and large trees remain a limiting factor on the landscape in many places and are important travel and breeding for many species. Treatments proposed adjacent to these stands aim to allow fire back onto the landscape in a way that would allow mixed and high intensity fire to play a role on the landscape without putting landscape connectivity for old growth dependent species at risk.

OW#8: Roadless – The EA proposes 219 acres of commercial logging in "undeveloped areas" but provides no map. The National Forest Management Act creates a continuing duty to maintain and update its inventory of forest values, such as unroaded areas that provide disproportionate ecosystem services. The EA does not describe where in the unroaded area there may be significant values, such as water quality, carbon storage, various habitats including interior habitat and accumulations of dead wood, unique vegetation, recreation, scenery, solitude. The EA does not provide a map of unroaded areas. The EA does not say where logging will overlap with unroaded areas.

Maps with a layer including the unroaded boundary OW provided were included in the analysis section of the project webpage. Differences between Alternative 2 and alternative 2M are a result of non-commercial units analyzed in Alt 2 being analyzed for biomass removal in Alt 2M. They are summarized as follows:

<u>Alternative 2</u>

Commercial Units 29, 32, 40, 41, 42, 49, 54, 66, 79, 84, 118, 119 are entirely within your identified unroaded boundary.

Commercial Units 21, 28, 33, 43, 45, 48, 68, 75, 85, 88 are partially located within the unroaded boundary.

Noncommercial Units 59, 69, 126-129, 160 are entirely within the unroaded boundary

Noncommercial Units 53, 130, 138 are partially within the unraoded boundary

<u>Alternative 2M</u>

Commercial Units 29, 32, 40, 41, 42, 49, 54, 66, 69, 79, 84, 118, 119, 127, 128, 160 are entirely within your identified unroaded boundary.

Commercial Units 21, 28, 33, 43, 45, 48, 53, 68, 75, 85, 88, 129, 138 are partially located within the unroaded boundary.

Noncommercial Units 59, 126 are entirely within the unroaded boundary

Noncommercial Unit 130 is partially within the unraoded boundary

<u>Alternative 3</u>

Commercial Units 29, 32, 41, 42, 49, 54, 66, 79, 84, 118, 119 are entirely within your identified unroaded boundary.

Commercial Units 21, 28, 33, 43, 45, 48, 68, 75, 85, 88 are partially located within the unroaded boundary.

Noncommercial Units 40, 59, 69, 126-129, 160 are entirely within the unroaded boundary

Noncommercial Units 53 and 138 are partially within the unraoded boundary

The EA failed to consider reasonable alternatives. Oregon Wild's scoping comments provided a map of unroaded areas contiguous to the nearby inventoried roadless areas and urged "the FS to consider an alternative that proposes only non-commercial vegetation management (without heavy equipment) and prescribed fire within all IRAs and uninventoried roadless areas." The EA failed to consider this reasonable alternative.

The FS considered your proposal as Alternative F, No commercial treatments in unroaded areas, but did not analyze it in detail.

Units identified in the unroaded boundary were analyzed for treatment, because they are located along key corridors for access into the Two Eagle project area. Many of the units share boundaries with ML3 NFS Roads 7700 and 7755 roads. Though some units also share boundaries with the IRA, each of the alternatives were specifically designed to respect the boundary of the congressionally defined Boulder Park IRA. Other intrinsic and biophysical components of the unroaded area, such as water and visual qualities, would be protected by project design criteria and mitigation measures (see Fish/hydro effects for appropriate RHCA buffers and the mitigation measures section in the EA).

In addition to being located along ML3 roads, units within the 7755 WSR are also within the WUI boundary. These management designations were analyzed for treatment as part of the holistic approach to preparing the landscape for fire, establishing defensible space around structures in the area, and preparing safer working conditions in the event of a wildfire in addition to preserving many of the desirable characteristics of the WSR. Please see the mitigations section for WSR related requirements, and the visuals/WSR specialist reports for more details on how the unroaded characteristics with overlapping ORVs would be affected.

Within the WSR, there are 4 HIM Units (5, 13, 66, 74), 2 Cottonwood Restoration Units (84, 120) and 14 HTH units (21, 23-29, 32, 33, 40, 41, 45, 48, 54, 66, 74).

OW#9: Roads have long-lasting impacts that should be avoided. There are already far too many roads on the National Forest and the FS cannot afford to keep them maintained. The FS should focus on treating areas accessible from existing roads. Areas that require roads can be treated non-commercially or with prescribed fire.

This was considered as Alternative E and was eliminated from detailed study. We agree that roads have long lasting impacts, and as a result no new system roads are proposed as a part of any alternative. Wherever possible, non-system user created roads were considered for access into units. All non-system temporary roads that are proposed will be rehabilitated to return the disturbed ground to regional soils standards.

OW#15: Cannot credibly assert that thinning for forest health justifies or mitigates emissions from logging. Logging does not increase the capacity for growing trees. To the contrary, logging harms soil and reduces site productivity.

We agree that all GHG emissions contribute to climate - related impacts, however, scale and carbon cycles must be taken into consideration. The direct effects from logging up to 2,533 acres on GHG emissions would be very small. The resulting indirect and cumulative contributions of GHGs *were estimated to be negligible in the context of global GHG emissions (See p. 180-183 of the EA). While we do acknowledge there are project-related contributions from to GHG on a very small scale, it is important to address the tradeoffs for treating the project area for projected climate scenarios consistent with the Climate Change Vulnerability and Adaptation in the Blue Mountains Region.*

OW#16: Must not compare carbon before and after logging. That is an improper framework for NEPA analysis. The proper NEPA framework is to compare the effects of NEPA alternatives over time, so please describe the carbon emissions and carbon storage in the forest over time with and without logging.

Our analysis was centered on the purpose and need statement, of which wildfire, insect and disease resiliency was a theme. Comparing carbon before and after logging, and its effects to wildfire behavior and projected emissions from reduced stand densities is measurable. Describing the carbon emissions and storage in the forest with and without logging would force us to assume no disturbances, and is not an analysis we can complete with either a qualitative or quantitative measurement.

OW#17: Logging to reduce fire effects does not result in a net increase in forest carbon storage. The agency cannot predict the location, timing, or severity of future wildfires, so most fuel treatments will cause carbon emissions without any offsetting benefits from modified fire behavior. Studies clearly show that the total carbon emissions from logging (plus unavoidable wildfire) are greater than carbon emissions from fire alone.

We agree that there is difficulty in predicting forest carbon storage, but do suggest there is an advantage to mimicking historic disturbances; healthy, vigorous and resilient stands may contribute to long-term carbon uptake. Although the exact numbers for carbon sequestration are difficult to analyze, we estimated that untreated stands may never fully recover after a severe disturbance in the projected climate scenarios (Anderson-Teixeira et all. 2013) which would result in a net reduction in carbon sequestration over time.

OW#18: Cannot credibly assert that carbon storage in wood products is a useful climate strategy. Logging kills trees, stops photosynthesis, and initiates decay and combustion, with the end result being a significant transfer of carbon from the forest to the atmosphere. In stark contrast, an unlogged forest continues to grow and transfer more carbon from the atmosphere to the forest. Carbon emissions caused by logging far exceed the small fraction of carbon transferred to wood products. Carbon accounting methods that attempt to account for substitution of wood for other high-carbon building materials are fraught with uncertainty and too often represent maximum potential substitution effects rather than lower realistic estimates.

We agree that carbon storage in wood products is not a useful stand-alone strategy for offsetting GHG emissions. It is just one way that carbon can be sequestered for a variable length of time (Skog et al. 2014).

OW #19: Retain Genetic Diversity

Two Eagle Response- We recognize the importance of conserving genetic diversity and that natural mortality provides an important ecological function. The current conditions of the Two Eagle Project Area, pages 2-6 in the silviculture report, indicates a shift in age structure, density and species composition within the stands of the Two Eagle Project Area. This has simplified landscape patterns, reduced biotic diversity and increase the risk of large, spreading disturbances that jeopardize remaining old forest patches and whitebark pine. The Eagle fire (2015) which occurred adjacent to the Two Eagle Project Area is evidence that the risk is very evident for larger disturbances that jeopardize remain old forest patches which contain valuable large diameter trees that have shown their fitness to survival.

As such, proposed treatments reflect a thoughtful management approach that aims to retain key forest components including genetic diversity. Treatment would promote residual tree vigor of large legacy trees that have survived previous climate extremes and shown their fitness to survival (no cutting of trees greater than 21”), while also promoting resiliency of the treated stand through retaining and promoting fire and drought tolerant species, reducing fuel ladders and managing stand structures to reduce fire behavior. Treatment in some instances would also promote and increase the vigor of known whitebark pine. These treatments are anticipated to increase the growth and vigor of residuals across the stand, as well as increase development of desired and underrepresented understory vegetation.

The follow responses are in regards to all literature brought up in the Oregon Wild Comments letter in regards to retaining genetic diversity:

A. **Halofsky, J.E.; Peterson, D.L., eds. 2016. Climate change vulnerability and adaptation in the Blue Mountains. Gen. Tech. Rep. PNW-GTR-xxx. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. (Table 6.8e)**

Two Eagle response- We recognize the importance of the natural role of insect disturbances within the Blue Mountains. The intent of this project is not to eliminate natural mortality caused from insects and disease from the landscape, but rather to restore and promote forest structure and compositional conditions reflective of the historic range of variability across the planning area. With this approach we address the increase of stand densities and the proportion of shade tolerant conifer species, described in the current conditions (EA page 4-5) which compete with white bark pine or large legacy drought tolerant species. Treatment in stands with establish white bark pine is designed to protect and enhance representation. Enhancing large legacy trees and whitebark pine on the landscape is critical, these strategies are listed in this same table of strategies that recognize the importance of the natural role of insect and disease disturbance. In fact, many adaptation strategies have been adopted from this source and guide our management strategies including but not limited to:

- *Manage forest vegetation to reduce severity and patch size; protecting refugia*
- *Create and maintain strategically located fuel reduction areas which “compartmentalize” the project area and reduce the potential size of wildfire, not eliminate it.*
- *Promote diversity of forest age and size classes*
- *Determine potential resilience of different locations, and actively restore less resilient sites*

- *In dry forest, restore low-severity fire to lower stand density and increase resilience to bark beetle outbreak*
- *Maintain vigorous existing western larch and ponderosa pine in moist mixed conifer forest*

B. Matthew Reilly, 2018. Chapter 2: Climate, Disturbance, and Vulnerability to Vegetation Change in the Northwest Forest Plan Area. Northwest Forest Plan Science Synthesis – Science Forum | Tuesday, June 26, 2018 | Portland, Oregon. https://docs.wixstatic.com/ugd/8f8000_08456f0927cb4aa88b18f341b3c7c435.pdf

Two Eagle response- we agree with the tactics discussed in the science forum such as protecting old trees, see prescription descriptions in the silviculture report (pg. 8-10) also note that no trees over 21" diameter at breast height are subject for removal. See OW#1.

C. Northern forests do not benefit from lengthening growing season. UNIVERSITY OF HELSINKI. PUBLIC RELEASE: 12-JAN-2010. http://www.eurekalert.org/pub_releases/2010-01/uoh-nfd011210.php.

Two Eagle response-This article references a paper published in the Forest Ecology and Management journal but does not give the title or author(s) of the paper. This article does not pertain to the Two Eagle project, as it focuses on forest in Finland adaptation to climate change. The purpose and need for the two eagle project is related to restoring and promoting forest structural and compositional conditions reflective of the historical range of variability and the overall landscape resiliency to future wildfire.

D. Derek Lee. January 14, 2017. Blog post: Proposed Forest Thinning Will Sabotage Natural Forest Climate Adaptation and Resistance to Drought, Fire, and Insect Outbreaks. http://dereklee.scienceblog.com/34/proposed-forest-thinning-will-sabotage-natural-forest-climate-adaptation-and-resistance-to-drought-fire-and-insect-outbreaks/

Two Eagle response- This article suggest that local genetic and epigenetic variation within populations of forest allows some individuals to naturally have a higher chance of surviving drought, fire and insect outbreaks. We acknowledge the importance of local genetic and epigenetic variation; however the legacy effects of past management which have created the existing condition, which are described in the purpose and need for the Two Eagle Project, state that they are out of sync to what we expect existed historically. This has elevated the risk for uncharacteristically large wildfires and insect outbreaks. The action alternative's aim (EA pages 17-20) is to develop stand conditions that can better accommodate climate change which corresponds with meeting the projects purpose and need. The action alternatives encourage gradual adaption to a warmer and drier environment by favoring drought and fire resilient trees, reducing stand density, and lowering fuel loadings. This would reduce the potential for catastrophic conversion due to climate change driven disturbance factors that are forecasted (see Forest Vegetation section).

Adaptive strategies included within the treatment design:

1. *Resistance options- manage forest ecosystems and resources so that they are better able to resist the influence of climate change or to stall undesired effect of change.*

2. *Promote resilience to change- resilient forests are those that not only accommodate gradual changes related to climate but tend to return toward a prior condition after disturbance either naturally or with management assistance. Promoting resilience is the most commonly suggested adaptive option discussed in a climate-change context- (Dale et al. 2001, Price and Neville 2003, Spittlehouse and Stewart 2003). Forest management techniques such as prescribed burning or thinning dense forest, can make forest more resilient to wildfire and insect outbreaks.*
3. *Enable forest to respond to change- This group of adaption options intentionally accommodates changes rather than resist it, with a goal of enabling or facilitating forest ecosystems to respond adaptively as environmental changes occur (Milar et al., 2007). Selected examples from the Two Eagle project of specific attributes to help enable the landscape to respond to change include diversifying the age classes of lodgepole pine and increasing the acreage of old growth ponderosa pine as the major forested ecosystem present on the forest.*

Treatments in Two Eagle are moving stands towards a more resilient and resistant condition that should help maintain biodiversity. Uncertainty in predictions of the amount of temperature and precipitation changes in mountain ecosystems is a major hurdle in designing efforts to respond to climate change (Millar et al. 2007). We recognize that monitoring for genetic variation is important to detect changes that threaten biodiversity and may improve the sustainability of applied forest management practices. We welcome the opportunity to work with the collaborative group to monitor treatments as part of the overall multi-party monitoring effort with a goal of increasing our mutual understanding of a forest population's capacity to survive, reproduce and persist under rapid environmental changes on a long-term scale.

Dale, V. H.; Joyce, L. A.; McNulty, S.; Neilson, R. P.; Ayres, M. P.; Flannigan, M. D.; Hanson, P. J.; Irland, L. C.; Lugo, A. E.; Peterson, C. J.; Simberloff, D.; Swanson, F. J.; Stocks, B. J., and Wotton, B. M. 2001. Climate Change and Forest Disturbances. Bioscience. 51(9) :723-734.

Halofsky, Jessica E. 2018. Adapting to the effects of climate change [Chapter 14]. In: Halofsky, Jessica E.; Peterson, David L.; Ho, Joanne J.; Little, Natalie, J.; Joyce, Linda A., eds. Climate change vulnerability and adaptation in the Intermountain Region [Part 2]. Gen. Tech. Rep. RMRS-GTR-375. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 404-509.

Millar, Constance; Stephenson, Nathan L.; Stephens, Scott L. 2007. Climate Change and Forests of the Future: Managing in the Face of Uncertainty. Ecological Applications 17(8): 2145-2151

Price, M.F., and G.R. Neville. 2003. “Designing Strategies to Increase the Resilience of Alpine/Montane Systems to Climate Change.” In Buying time: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems, ed. L.J. Hansen, J. l. Biringer, and J.R. Hoffman, 73-94. Berlin: World Wildlife Fund.

E. Beth Roskilly, Eric Keeling, Sharon Hood, Arnaud Giuggiola, Anna Sala. Conflicting functional effects of xylem pit structure relate to the growth-longevity trade-off in a conifer species. Proceedings of the National Academy of Sciences, 2019; 201900734 DOI: 10.1073/pnas.1900734116.

Two Eagle Response- Again, we acknowledge the importance of local genetic and epigenetic variation; however the legacy effects of past management which have created the existing condition, which are described in the purpose and need for the Two Eagle Project, are out of sync to what we expect existed historically and at elevated risk to uncharacteristically large wildfires and insect outbreaks. Ponderosa pine in proposed treatment areas are located in high density stands that are under greater competition soil moisture. This reduces ponderosa pines ability to resist bark beetle attacks which historically are shown through areal detection surveys are currently occurring in this area. The principals in this paper have been incorporated in the treatment design.

F. Richard Shiffman interview with Diana Six. 04 JAN 2016: INTERVIEW- How Science Can Help to Halt The Western Bark Beetle Plague http://e360.yale.edu/content/feature.msp?id=2944

Six, Diana L.; Vergobbi, Clare; Cutter Mitchell. 2018. Are Survivors Different? Genetic-Based Selection of Trees by Mountain Pine Beetle During a Climate Change-Driven Outbreak in a High-Elevation Pine Forest. Frontiers in Plant Science 9(993). https://doi.org/10.3389/fpls.2018.00993; https://www.frontiersin.org/articles/10.3389/fpls.2018.00993/full.

Two Eagle Response- These two citations are related to each other and have been combined for response purposes. The first is an interview with Diana Six, the second is a paper authored by her and two others. See OW# 4 & 5 responses.

G. Wuerthner, George. 3-28-2017 Email to Deschutes Collaborative via Vernita Ediger, *citing* Kolb, T.E., Grady, K.C., McEttrick, M.P., and A. Herrero 2017. Local-Scale Drought Adaptation of Ponderosa Pine Seedlings at Habitat Ecotones. For. Sci. 62(6), pp.641-651.

Pinnell, Sean, 2016. MS Thesis: "Resin Duct Defenses In Ponderosa Pine During A Mountain Pine Beetle Outbreak: Genetic Effects, Mortality, And Relationships With Growth" (2016). Paper 10709. http://scholarworks.umt.edu/cgi/viewcontent.cgi?article=11753&context=etd.

Two Eagle Response- These two citations were combined in the comment letter and have been combined for response purposes. The first paper suggest that the potential for future evolution of stress tolerance for ponderosa pine may come from phenotypic variation for a species growing at ecotonal sites near the trailing edge of their geographic range where the impacts of climate warming are predicted to be most severe. Families with the longest survival in lethal drought tended to come from low-elevation, drier sites.

The second paper discusses that drought preceding a beetle outbreak may predispose some trees and families to higher mortality due to differential production of resin duct defense. Resin duct defenses decree mortality and faster growing trees have more resin duct *defenses, faster growing families did not exhibit lower mortality. This suggest that breeding programs aimed at increasing growth rates may reduce the likelihood of beetle-induced mortality during endemic to epidemic stages.*

The principals of these two papers have been considered and are incorporated in the treatment design. The majority of the treatments in this project are intermediate treatments and do not require replanting. Rather proposed treatments reflect a thoughtful management approach that retains key forest components, like large diameter trees and promotes fire and drought adapted species. The limited planting within this project (See EA page 145) serves two purposes: enhance whitebark pine stands by planting white pine blister rust resistant stock and enhance drought tolerant species composition in stands that have no seed source for early seral species due to past management.

H. Black, S. H., D. Kulakowski, B.R. Noon, and D. DellaSala. 2010. Insects and Roadless Forests: A Scientific Review of Causes, Consequences and Management Alternatives. National Center for Conservation Science & Policy, Ashland OR. http://www.geosinstitute.org/images/stories/pdfs/Publications/RoadlessAreas/FireandBugReport.pdf.

http://www.xerces.org/wp-content/uploads/2010/03/insects-and-roadless-forests1.pdf

Two Eagle Response- this article address treatment in roadless areas in response to recent bark beetle epidemics. It is important to note that the Two Eagle project does not propose treatment in any roadless areas. Many findings recommended in this publication have been considered and are reflected in the analyses completed by all resources for the Two Eagle Project Area. See OW #4.

I. Black, S.H. 2005. Logging to Control Insects: The Science and Myths Behind Managing Forest Insect "Pests." A Synthesis of Independently Reviewed Research. The Xerces Society for Invertebrate Conservation, Portland, OR. http://www.xerces.org/wp-content/uploads/2008/10/logging_to_control_insects1.pdf

Amman, G.D. 1977. The role of the mountain pine beetle in lodge pole pine ecosystems: Impact of succession. In *The Role of Arthropods in Forest Ecosystems: Proceedings in the Life Sciences,* W.J. Mattson, ed. Pp. 3–18. New York: Springer–Verlag. https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1110&context=barkbeetles

Two Eagle Response- These two citations were combined in the comment letter and have been combined for response purposes. See OW A.

OW#19: Basal Area

The follow responses are in regards to all literature brought up in the Oregon Wild Comments letter in regards to basal area retention:

OW #10-Quantitatively disclose basal area retention. The NEPA analysis should consider alternative levels of basal area retention that resolve trade-offs in different ways. Where there are lots of small trees we recommend variable density thinning to 60-80 sq ft/acre basal area, retaining the largest trees that will become the next generation of old growth. Since larger trees have a higher ratio of basal area to leaf area, sites with abundant large trees can sustain higher basal areas, and we recommend retaining 100-140+ sq ft/acre.

Powell 1999, https://fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev7_016034.pdf)

Two Eagle Response- This publication is used to determine stocking levels for all stands in Two Eagle. During the recon/diagnosis phase this publication was used to prioritize stands for treatment. Plant associations were determined for each treatment unit across the Two Eagle Project Area. Cochran et al. (1994) determine the sites carrying capacity, expressed as stand density index, for tree species based on the plant association group. Full stocking, a stand development benchmark, indicates tree vigor has slowed to a point where trees are self-thinning and have an increased likelihood of mortality agents. Stands proposed for treatment are at or above this benchmark.

Below full stocking, is the lower and upper limit of a management zone where partial to full competition occurs, and inter-tree competition and mortality agents are less common. These stocking level thresholds are percentages of full stocking and help assess relative growth and inter-tree competition. Basal area and trees per acre values based on the stand quadratic mean diameter for upper and lower level management zone for each species were derived by Powell (1999). Overall recommended stocking level for a stand reflects the species with the lowest stocking level recommendation (Powell 1999). This strategy assumes that the species with the lowest stand density index value has the most restrictive stocking requirements, and that other species would develop acceptably under the lower densities established for the limiting species.

Marking guides for Two Eagle units will use this publication to determine target basal area as a way to easily apply and estimate it in the field and monitor or evaluate stand treatment marking.

J. Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001)

Two Eagle Response- Snag retention guidelines outlined in the Forest Plan were determined to be inadequate for the needs of primary cavity excavators and were replaced by the Regional Forester's Plan Amendment #2 (Eastside SCREENS) which incorporated more recent research. In addition to following the guidelines laid out in the SCREENS, integration of the latest science is incorporate into the analysis using the DecAID Advisor Version 2.2 (Mellen-McLean et al. 2012) which is an internet-based meta-analysis of the best available science: published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgement and experience. This represents some of the best available data showing distribution and variation in snag amounts across the landscape. FSVeg analysis is used to examine snag retention based on treatment to ensure snag levels will not drop below Forest Plan standards. For a full discussion of these analyses refer to the EA (page 99-103).

Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2012. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.20. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://apps.fs.fed.us/r6_decaid/legacy/decaid/index.shtml

AFRC #23: Remove Mitigations and PDCs from the body of the EA and place in an appendix.

We agree that including this section in the EA is not a NEPA requirement, however, including PDCs and mitigation measures in the body of the EA provides a better understanding of how closely resource specialists evaluated their concerns and linked them to a determination for their resource.

AFRC #24: Thinning in RHCAs accelerates production of large trees.

Commercial thinning in RHCAs is prescribed in three units designed to enhance cottonwood stands, and hand thinning in three meadows to enhance mule deer habitat. In all other units, appropriate RHCA buffers will be applied (see fisheries specialist report for specific buffers).